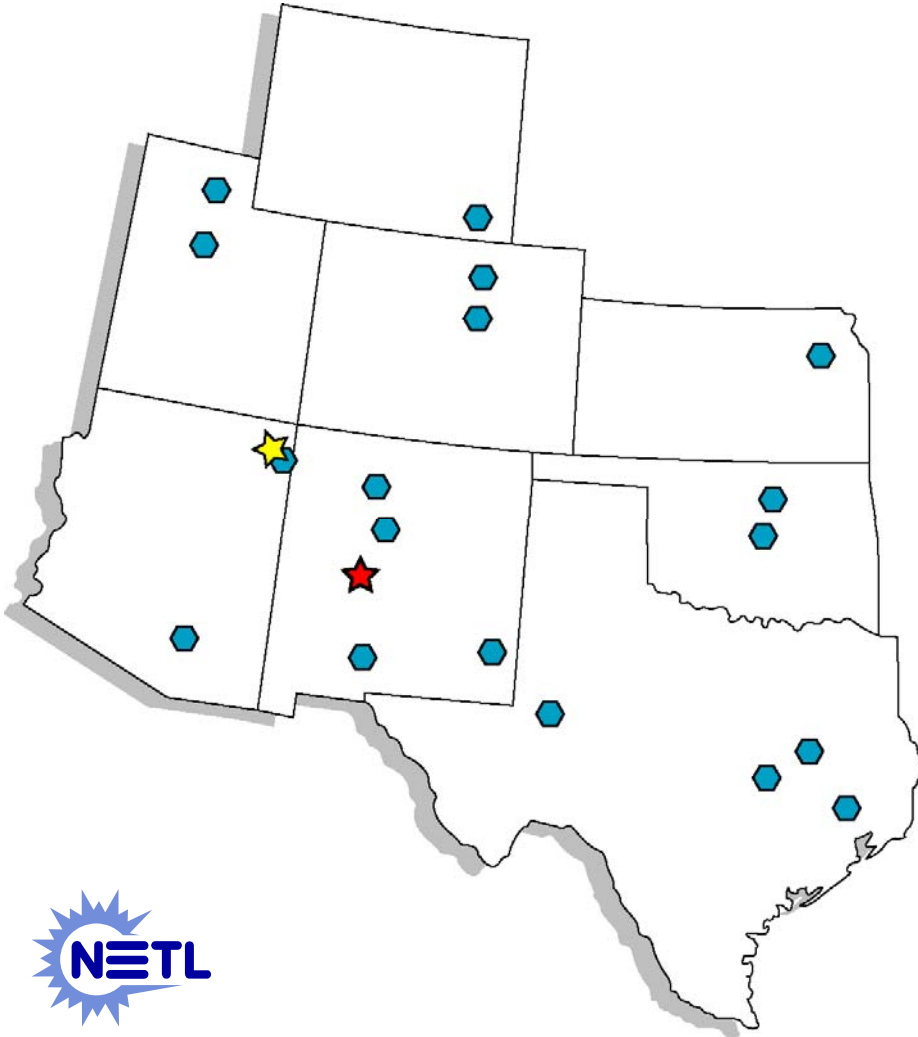


# *Southwest Regional Partnership on Carbon Sequestration*



## Southwest Terrestrial Project Overview

DE- FC26-05NT42591

December 13, 2007

Pittsburgh, Pennsylvania

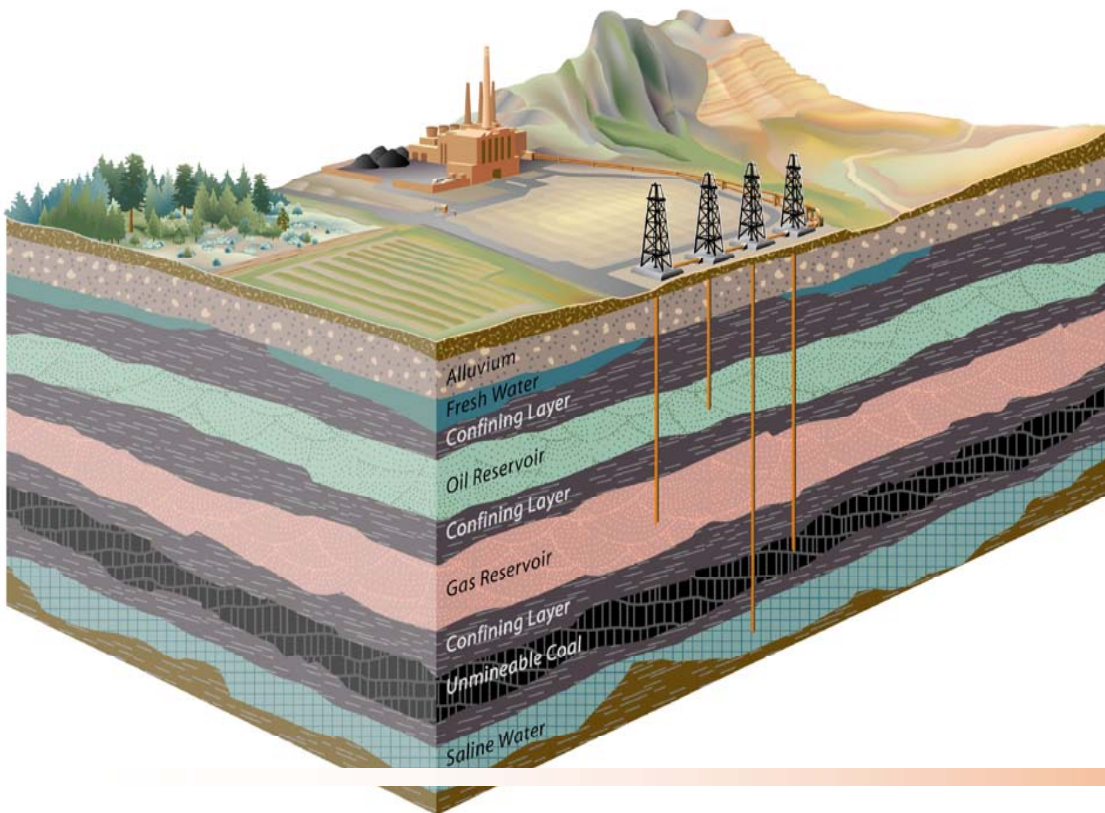


# Southwest Phase II Portfolio

## Terrestrial

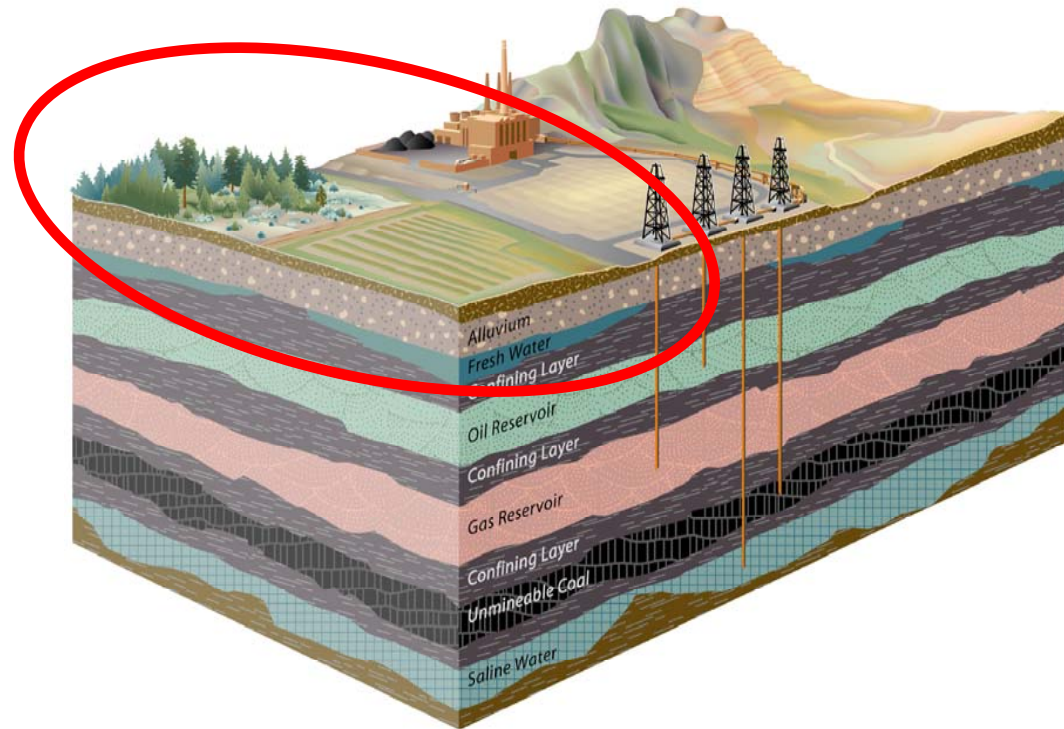
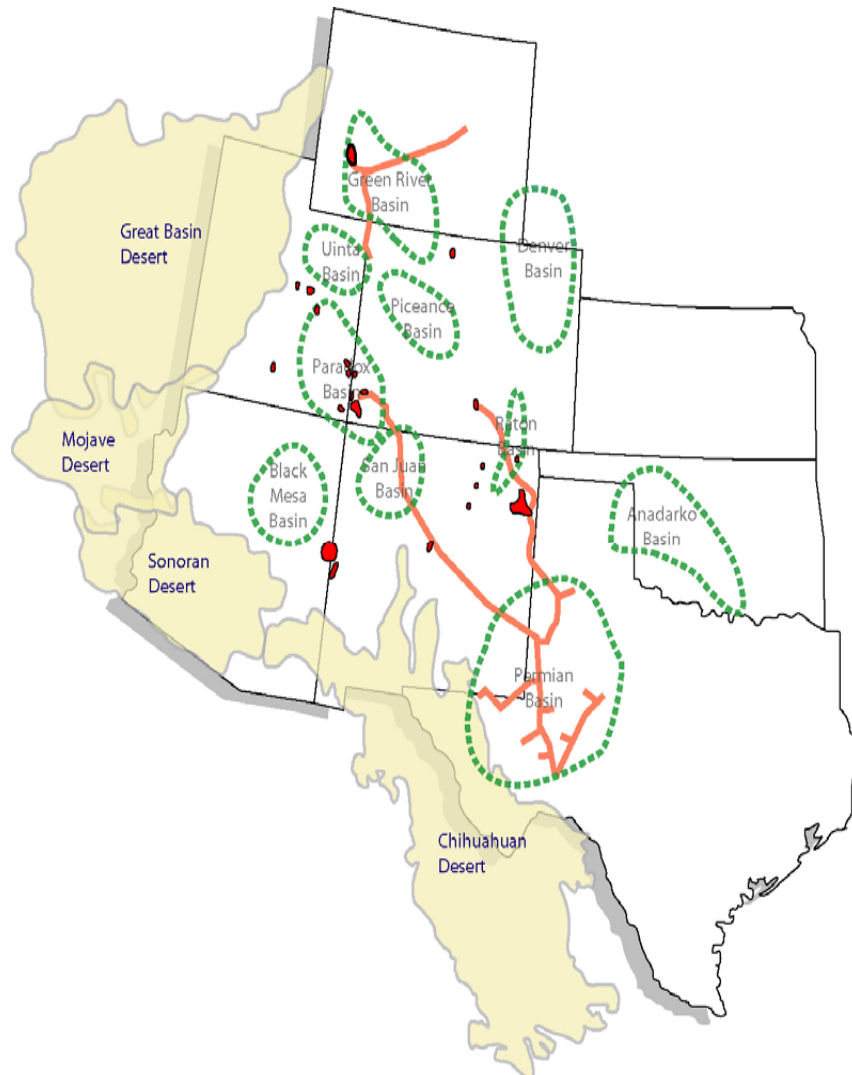
Regional accounting  
protocols

Landscape restoration  
with produced water



# Southwest Phase II Portfolio

## Analysis: Duration of Phase II



### Regional Project

- Land-use and management changes
- Incentive programs and effects
- Improved MMV and reporting
- Effects of natural vegetation changes

# Phase I

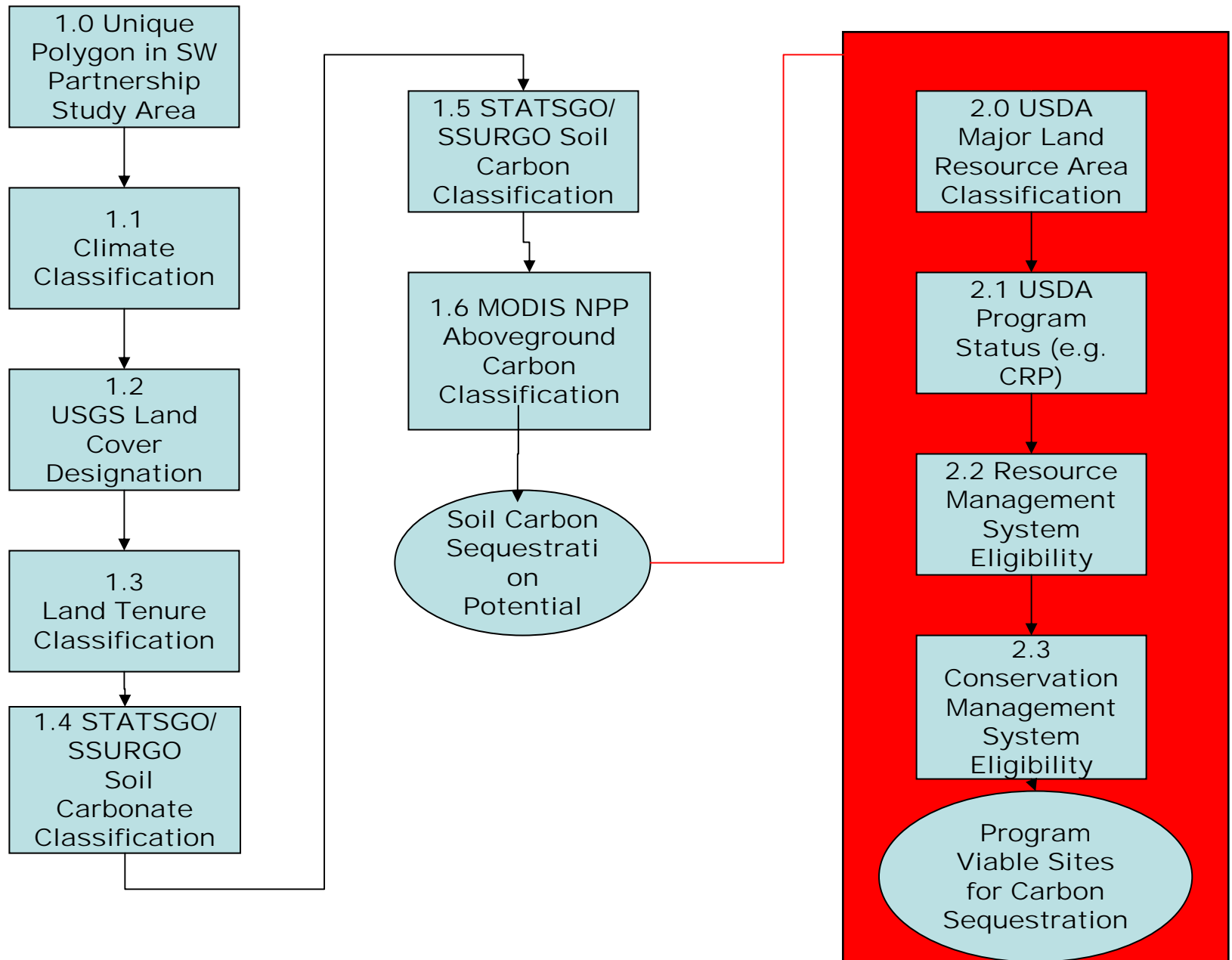
Consistency

Transparency

Accessibility

Reality

# IDENTIFYING POTENTIAL SITES for SEQUESTRATION



# COMET VR

Voluntary Reporting Carbon Management Site (COMET-VR) - REPORTING ONLINE TOOL - Mozilla Firefox

http://www.cometvr.colostate.edu/tool/default.asp?suffix=CL%3Aclay+loam

Enter the management history for this parcel: ?

Management For this Time Period: Choose Rotation:

Landscape position and historical management:

1970's through mid-1990's:

Enrollment in Conservation Reserve Program (CRP) during 1990's?

Select the CRP type:

Base (Current Mgmt.):

See Also:

- NREL Agroecosyste
- CASMGIS Consortium
- Agricultural Soils
- Mitigation of Greenhouse Gases
- ARS Research
- U.S. Agriculture & Forestry Greenhou Gas Inventory
- Greenhouse Gas Reporting Guidelin
- Draft 1605b Techn Guidelines
- Voluntary Reportin Program

Voluntary Reporting Carbon Management Site (COMET-VR) - REPORTING ONLINE TOOL - Mozilla Firefox

http://www.cometvr.colostate.edu/tool/default.asp?base=irrigation+%28pre+1

Voluntary Reporting Carbon Management Tool COMET-VR (Beta)

Go to | Reset | State | County | Parcel | Soil | Rotation | Tillage |

Step 6. Enter the land management information: Choose a tillage for the three time periods.

EL PASO County, Colorado Tillage History for Parcel 1

Enter the management history for this parcel: ?

Tillage For this Time Period: Choose Tillage:

1970's through mid-1990's:

Base (Current Mgmt.):

2005 Report Period:

Back Reset Next

Selection

Location Information:

- State: Colorado
- County: EL PASO
- MLRA: 49
- LRR: E

Parcel Information:

- Report Date: 7/12/2
- Name: Parcel 1
- Size: 1 Acres

Soil Information:

- Texture: Clay Loam
- Hydric: N

Management History:

- Historic: Irrigation (pre 1970's)
- 70's - 90's: dryland: mechanical fallow-winter wheat, CRP: None
- Current: CRP, 100% grass,,
- Report Period: C 100% grass,,

Voluntary Reporting Carbon Management Site (COMET-VR) - REPORTING ONLINE TOOL - Mozilla Firefox

http://www.cometvr.colostate.edu/tool/default.asp?action=7&dynamicLRR=Lrr5

Voluntary Reporting Carbon Management Tool COMET-VR

Carbon Storage Report ?

Report Year: 2005

Parcel Description

|              |                      |
|--------------|----------------------|
| Parcel Name: | Parcel 1             |
| Parcel Size: | 1 Acres              |
| Location:    | EL PASO, Colorado    |
| Soil:        | Non-hydric Clay Loam |

Parcel Management History

|                |  |
|----------------|--|
| Historic:      | irrigation (pre 1970's)                                    |
| 70's to 90's:  | dryland: mechanical fallow-winter wheat; Intensive Tillage |
| Current:       | CRP, 100% grass; No Till Tillage                           |
| Report Period: | CRP, 100% grass; No Till Tillage                           |

Predicted Change in Soil Carbon for the Parcel

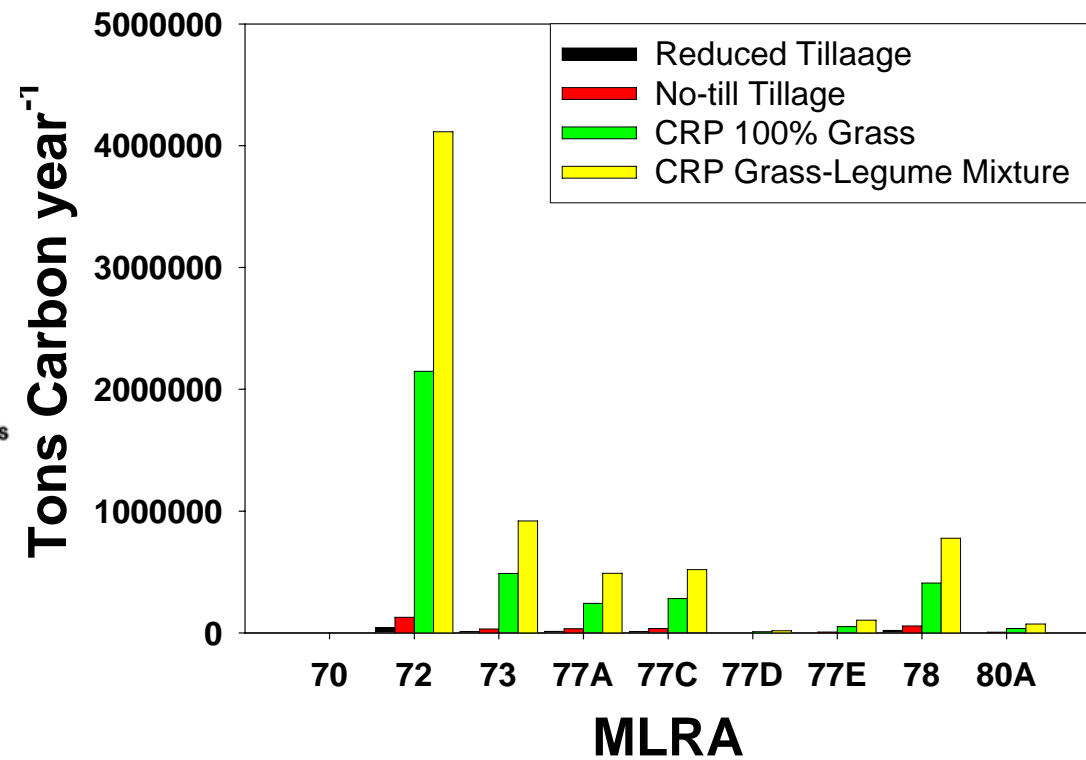
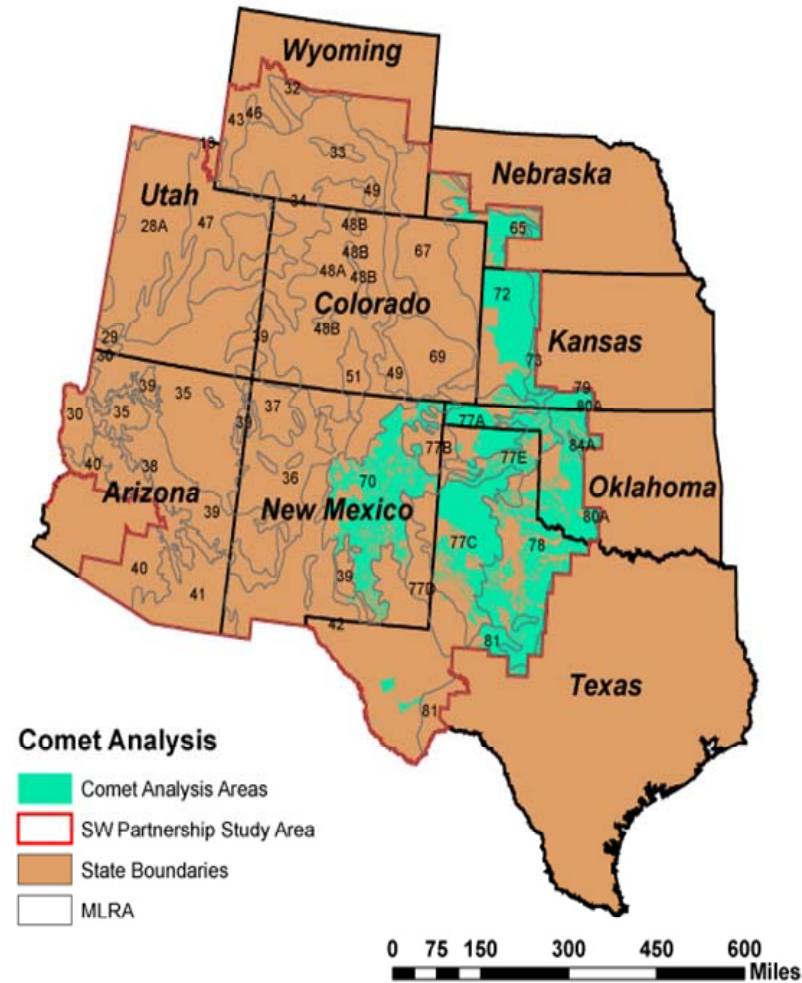
Annual Change for 2005

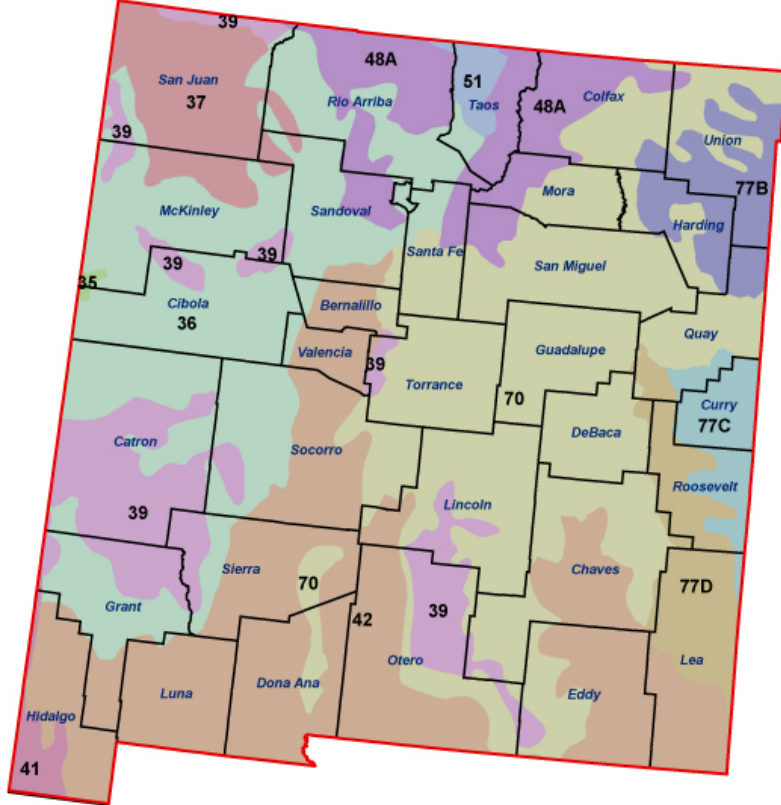
|                                     | Change in Carbon | % Uncertainty ? |
|-------------------------------------|------------------|-----------------|
| Total Tons Carbon per year:         | -0.056584        | 8.84            |
| Total Tons CO2 Equivalent per year: | -0.207324        | 8.84            |





## Small Grains





# MLRA 70 Pecos Canadian Plains and Valleys

- 2, 250, 308 ha
- Cropland-irr. corn to perennial grass  
8677 ha (0.6 T C/ha/y)
- Cropland-small grain to perennial grass  
3474 ha (1.1 T C/ha/y)
- No till gains little carbon



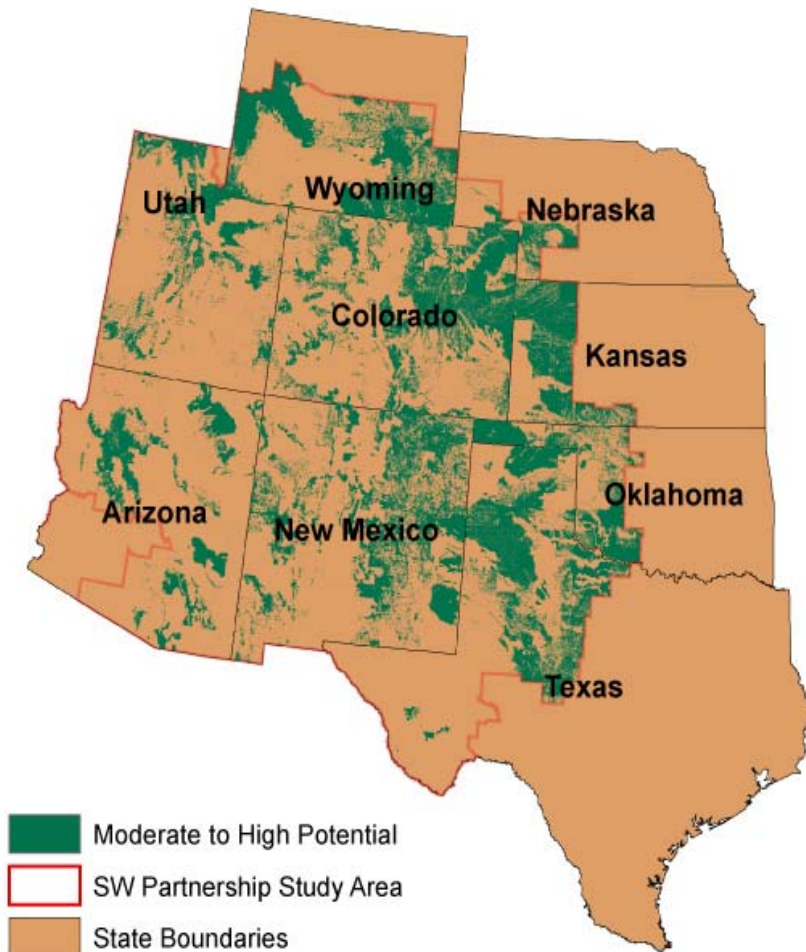
# Phase I Impact

**COMET VR applications in  
1605b program**

**Results are in the hands of  
policy makers at national  
and state levels**

**Pending Farm Bill**

**Chicago Climate Exchange**



# COMET VR

Voluntary Reporting Carbon Management Site (COMET-VR) - REPORTING ONLINE TOOL - Mozilla Firefox

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Back Reset Next

Voluntary Reporting Carbon Management Site (COMET-VR) - REPORTING ONLINE TOOL - Mozilla Firefox

Voluntary Reporting Carbon Management Tool COMET-VR

Carbon Storage Report ?

Report Year: 2005

Parcel Description

|              |                      |
|--------------|----------------------|
| Parcel Name: | Parcel 1             |
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Predicted Change in Soil Carbon for the Parcel

Annual Change for 2005

|                                     | Change in Carbon | % Uncertainty ? |
|-------------------------------------|------------------|-----------------|
| Total Tons Carbon per year:         | -0.056584        | 8.84            |
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# Phase II

## Resolving uncertainty

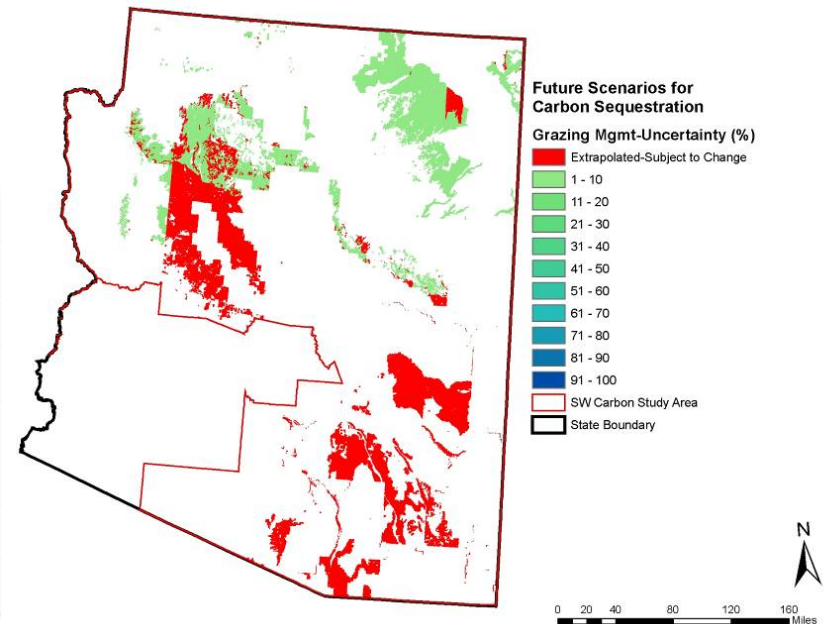
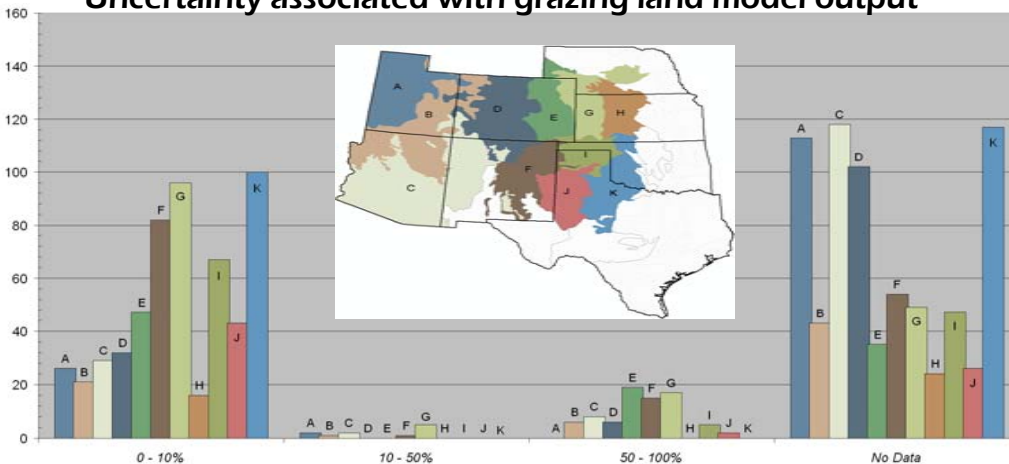
Direct measurement of carbon levels

Prediction tools

Land classification and remote detection

Integration into decision making

Uncertainty associated with grazing land model output

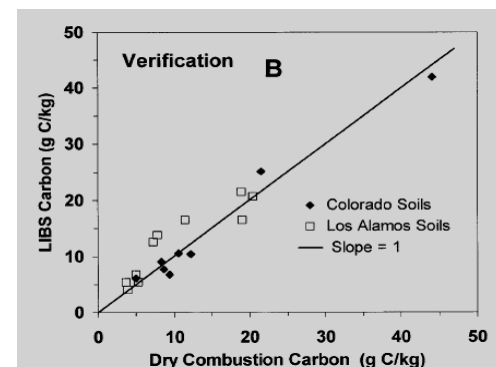
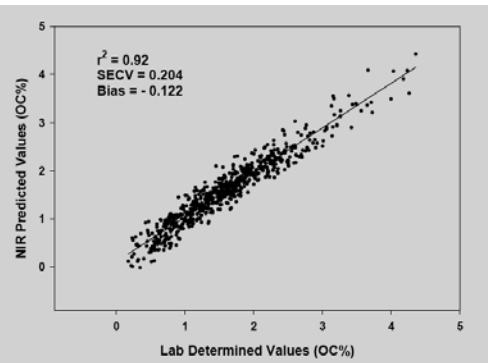


# Direct Measurement

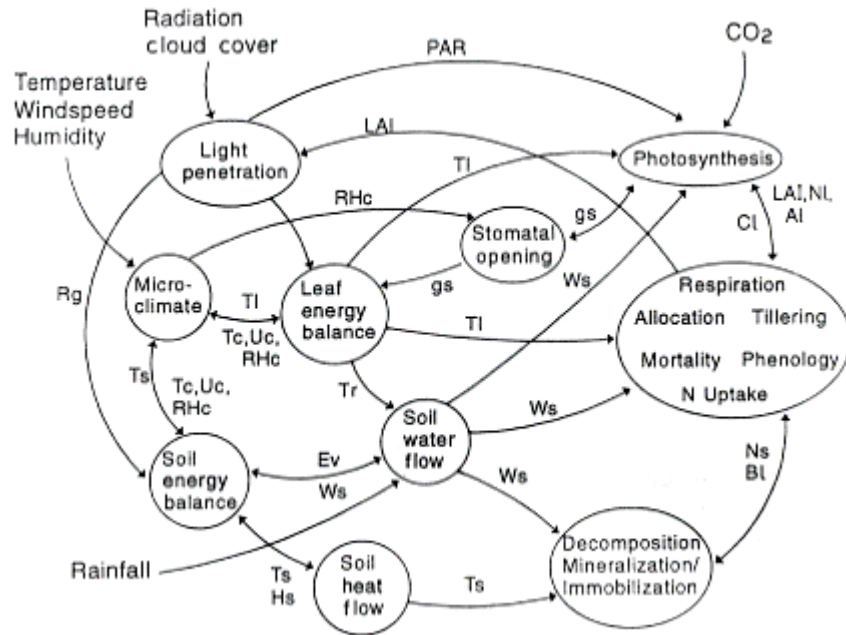
- Develop improved technologies and systems for direct measurements of soil and vegetation carbon at reference sites selected within the SW Region



- LIBS and NIRS
- Collect at existing long-term study sites
- Correlation with other technologies
- Principles for cost effective sampling



# IMPROVED PREDICTION



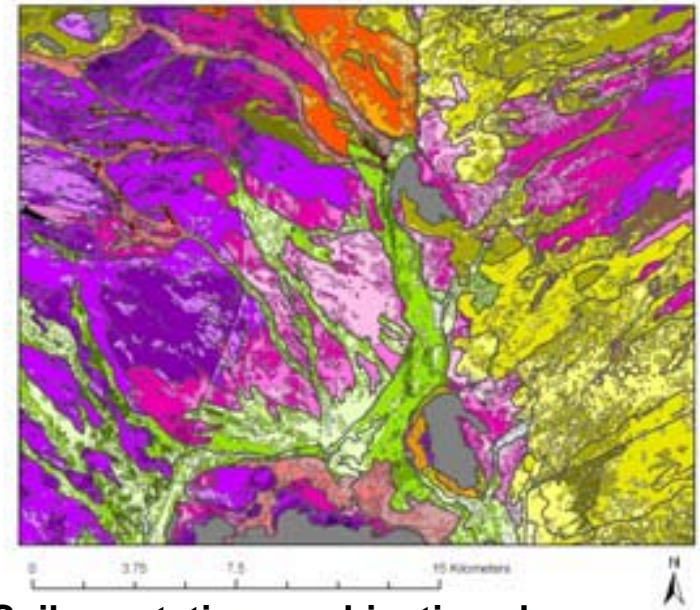
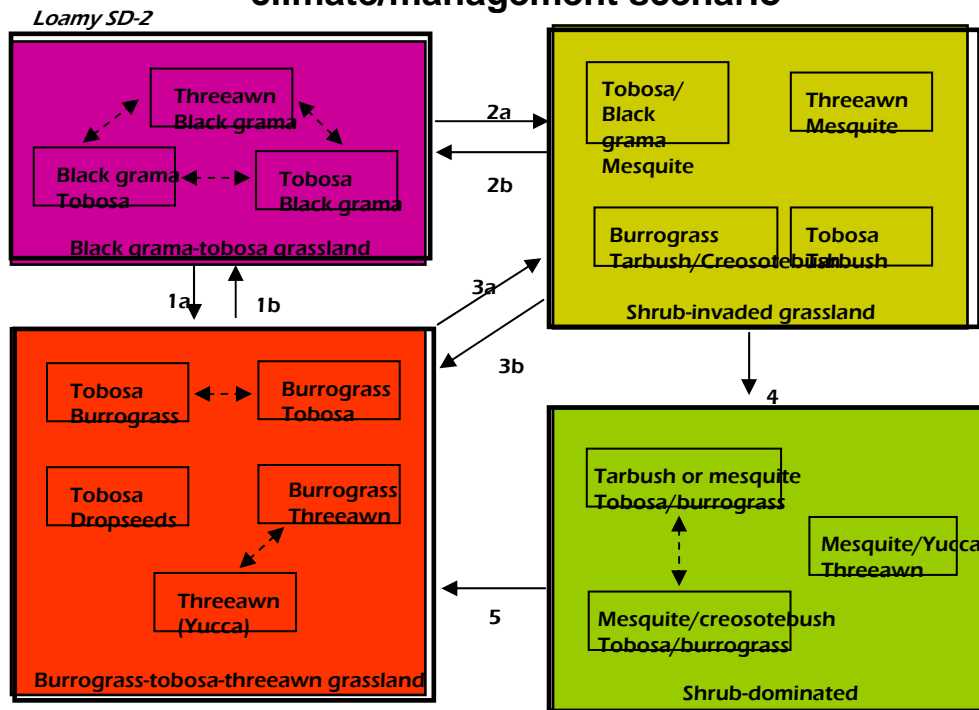
- 800 samples contrasting intact vs degraded sites
- Land use history and characterizations complete
- Calibration of CENTURY model





# Land classification and remote sensing

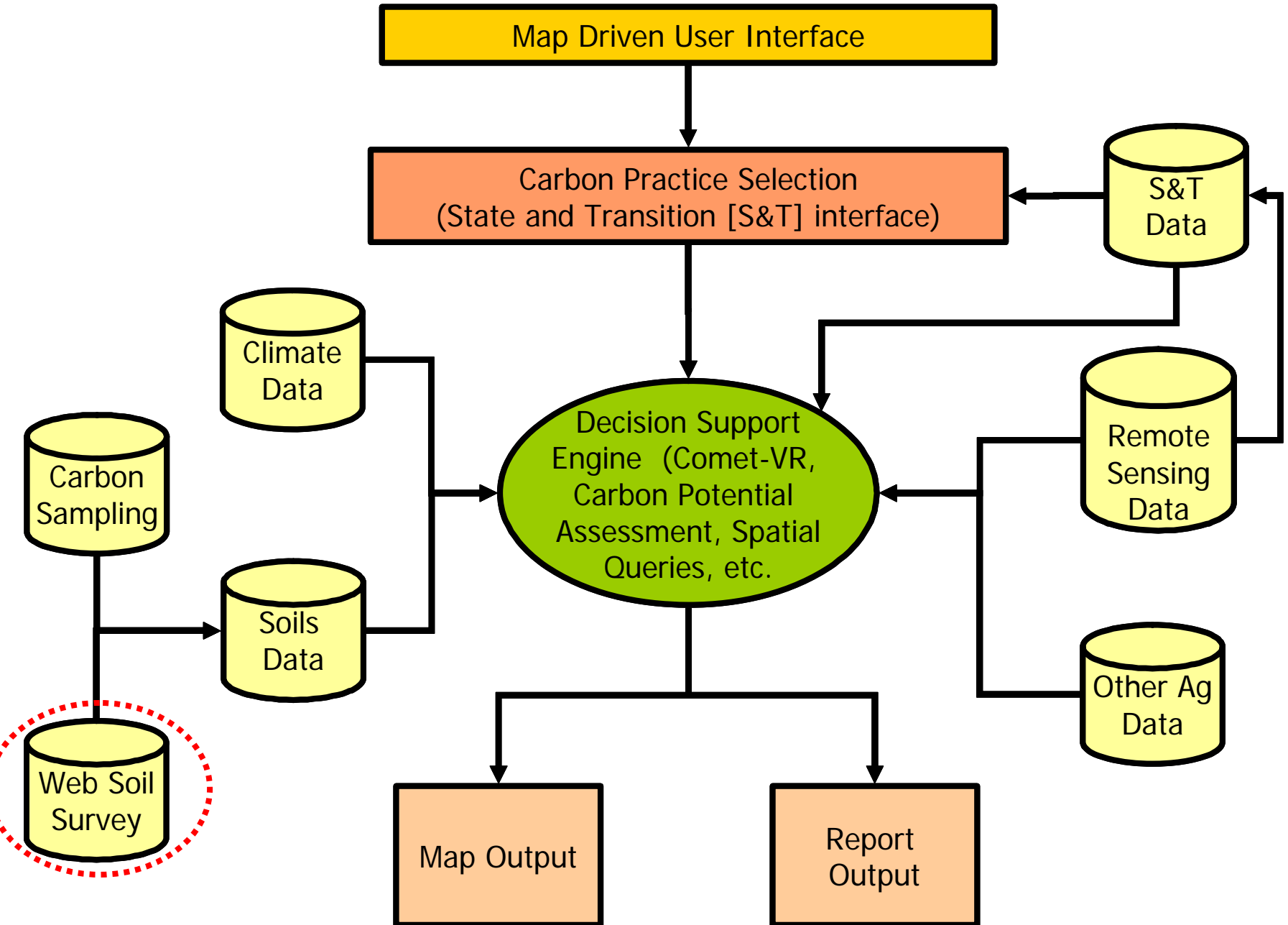
- State and Transition Models are components of Ecological Site Descriptions
  - ESDs are accessible via the Web Soil Survey
  - Each state has values for common ecosystem services
  - Each transition has a probability of occurrence under specific climate/management scenario



- Soil:vegetation combinations have been mapped for 5 million acre in southern New Mexico
  - Methods include use of ASTER imagery, eCognition image classification software, and aerial photography for verification
  - Units are mapped with a high level of accuracy
  - Able to classify vegetation “states”

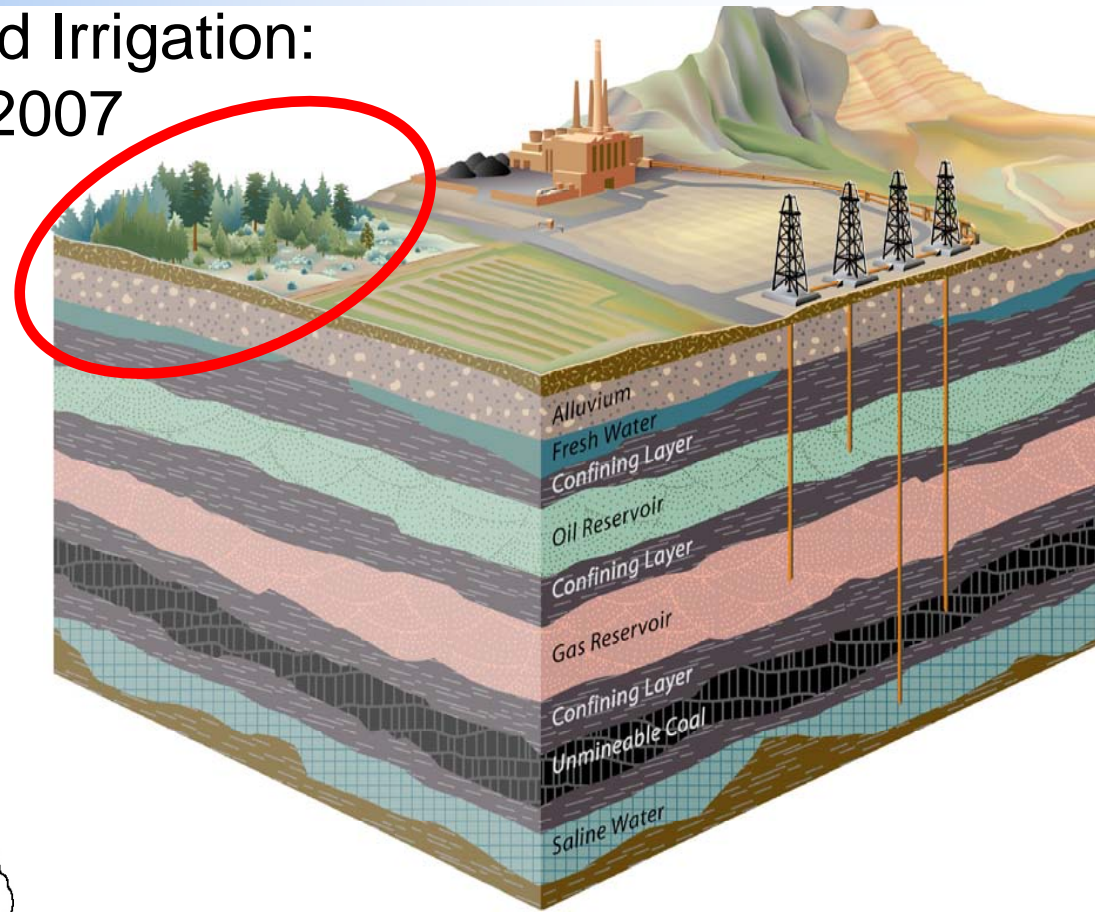
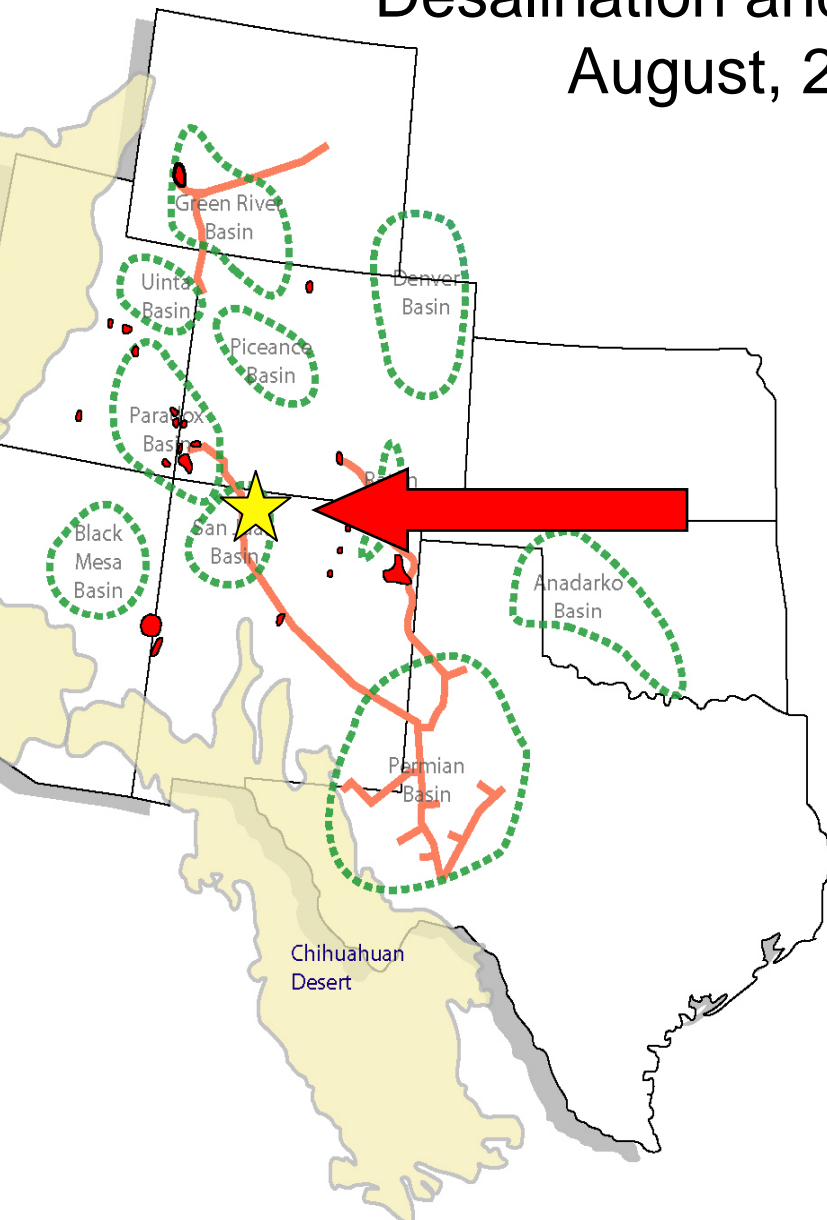


# Decision Making



# Southwest Phase II Portfolio

Desalination and Irrigation:  
August, 2007

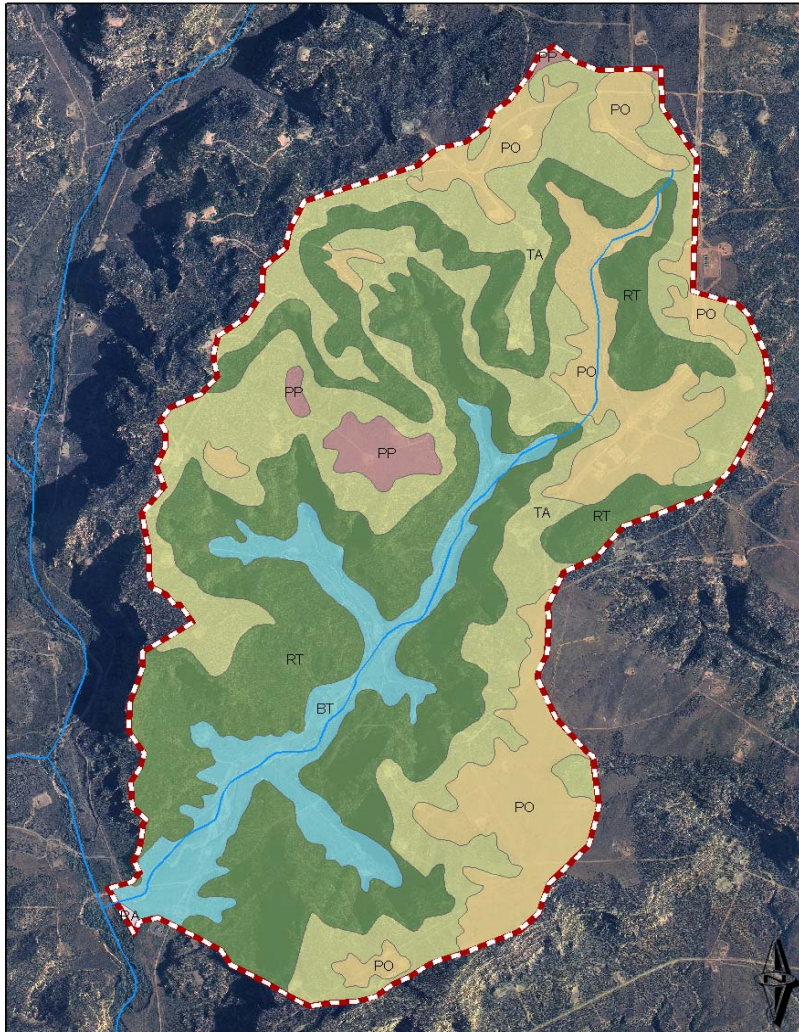








**San Juan Basin, NM: 75,000 tons/year**

- Combined enhanced coalbed methane recovery with sequestration
- **Surface riparian restoration for terrestrial sequestration**

# ANALYSIS AND RESTORATION OF DEGRADED LANDSCAPES

## LaManga Canyon



| Symbol  | Soil | Name                         | Percent of Area |
|---|------|------------------------------|-----------------|
|  | BT   | Blancot-Notal association    | 10.2            |
|  | PO   | Penistaja loam               | 17.0            |
|  | PP   | Penistaja-Buckle association | 1.8             |
|  | RA   | River Wash                   | 0.1             |
|  | RT   | Rock-Travessilla-Weska cmplx | 40.3            |
|  | TA   | Travessilla-Weska-Rock cmplx | 30.6            |



La Manga Canyon Watershed

- Soil carbon analysis of San Juan Basin landscapes affected by grazing and energy exploration

- Increased pinon-juniper, decreased sagebrush, invasive cheatgrass, downcut drainages

- Use of produced water for restoration

- New filtration technologies for cleaning water

- Distribution technologies to enhance survival of planted species

- Selection of appropriate species for reseedling

- Landscape scale restoration

Southwest Regional Partnership for Carbon Sequestration



# Phase II Progress: New Mexico Terrestrial

- *Riparian restoration irrigation plans completed*
- *Riparian MMV plans completed*
- *bench-scale humidification-dehumidification desalination unit was completed, tested and produces several gallons/day*
- *a pilot-scale desalination unit is finished (shown at right) and is deployed producing 100 gallons/day for irrigation*



# Coal Bed-Methane Produced Water for Vegetation Establishment

- **Objectives:**

1. Selected cultivars that are salt tolerant.
2. What is the breaking point for TDS (total dissolved salts) affecting plant growth.

**This is not agronomy and we are not growing forage  
we are seeking plants that can  
survive with a minimum of added  
water and can tolerate drought  
and herbivory**



# Stabilizing and restoring damaged landscapes



- Energy exploration, along with historical grazing and recreation uses have degraded landscapes
- Limited resources for restoration
- Arid, highly variable landscapes
- Potential for substantial infrastructure damage and safety threats

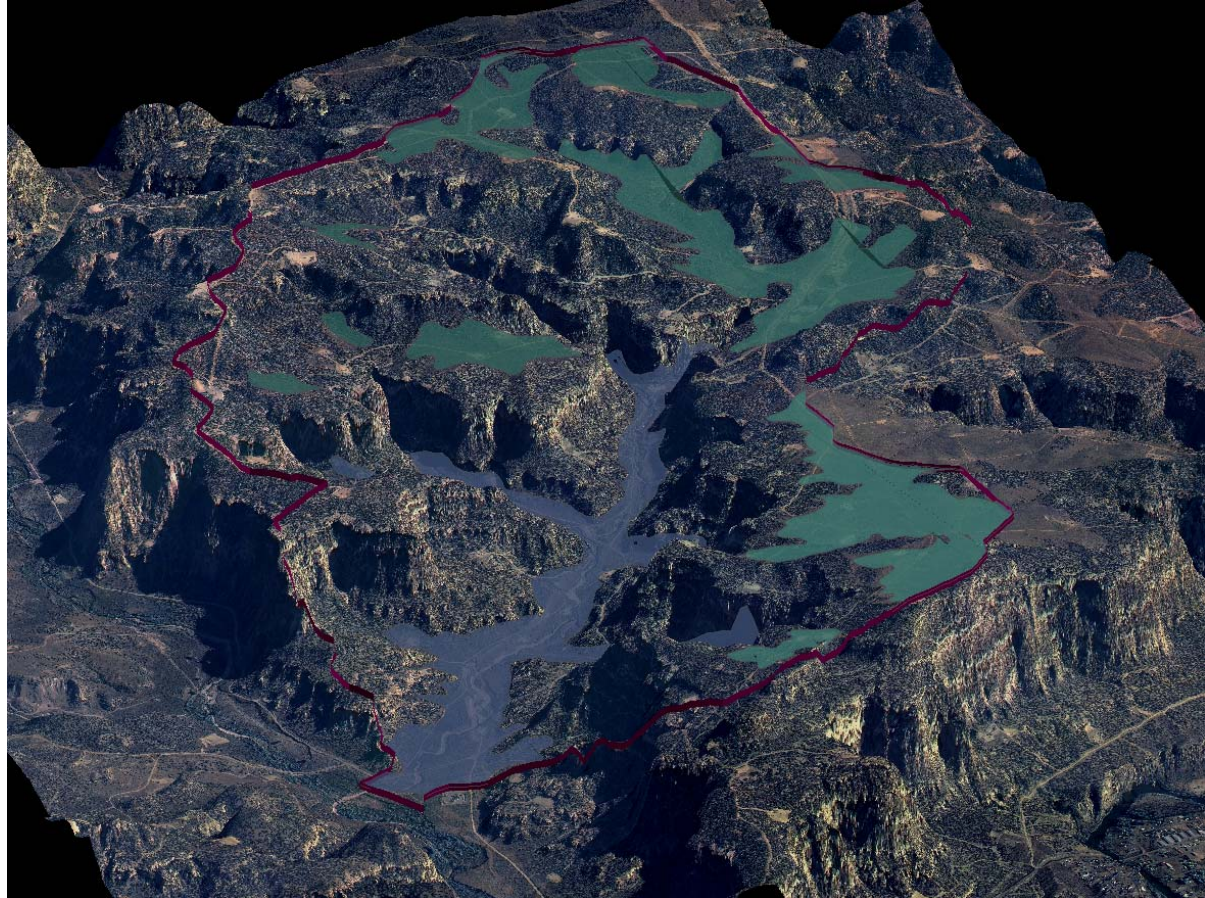


# RIPARIAN RESTORATION



- Loss of riparian areas to erosion results in terrestrial carbon losses
- Soils are high in carbon
- Loss of soils reduces opportunity to sequester more carbon

- **LANDSCAPE COMPONENTS WITH THE GREATEST POTENTIAL FOR RESTORATION**
- **REQUIREMENTS FOR PLANT RESTORATION AND SOIL STABILITY**
- **PREDICTIVE MODELS OF CARBON SEQUESTRATION POTENTIAL**



# **SOIL CARBON MANAGEMENT IN THE SOUTHWEST REGION**

- **Nature is not our friend**
- **Existing, proven technologies can be combined to provide reliable, accurate and accessible information for land managers, policy makers and the commercial markets**
- **Cost effective technologies for MMV are available, but will require substantial efforts for integration**
- **Key is multidisciplinary, outcome based approach**



# Acknowledgements

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- Many thanks to the U.S. Department of Energy and NETL for supporting this project
- We express our gratitude also to our many industry partners, who have committed a great deal of time, funding and other general support for these projects
- The work presented today is co-authored by all partners in the Southwest Partnership